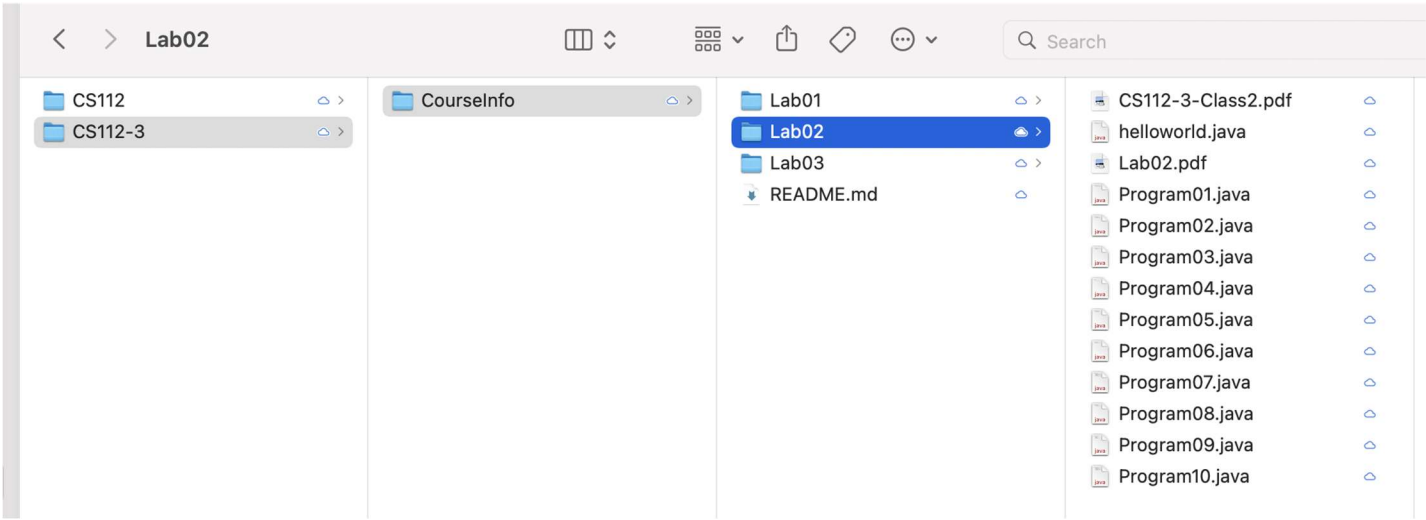
Directories, Files, Terminal and Commands

WHAT IS A FILESYSTEM?

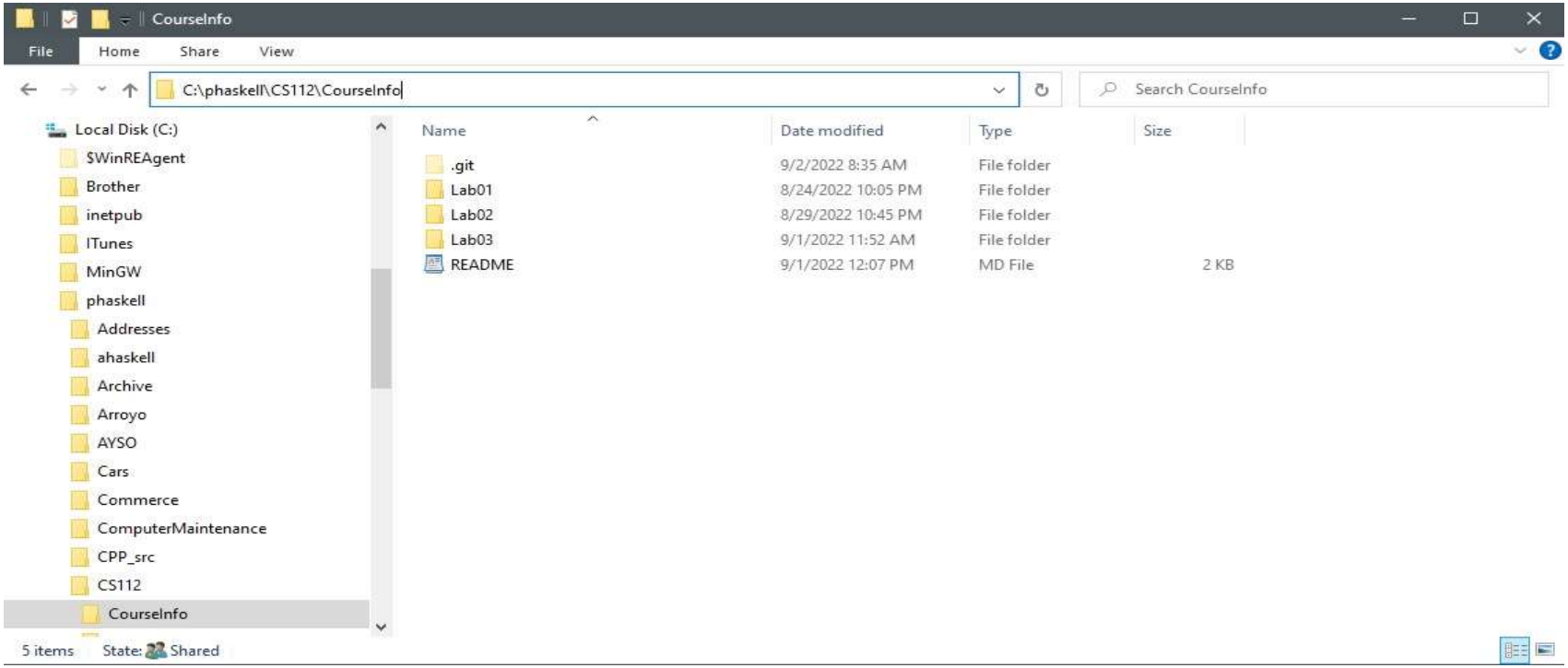
- The files stored on your computer, and every computer, are located in a hierarchical structure called a filesystem.
- What are files? A file is just a sequence of data with a filename. The data can be a java source file, an executable program, PDF file, text file, or any other kind of data.
- The filesystem uses “directories” to store files. A directory can also store other directories, called “subdirectories”
- Why do we need Directories and Files? The hierarchy of directories, subdirectories, and files is useful to organize information. Files contain information. The hierarchy of directories and subdirectories organizes the files.



- In most file systems, the topmost directory is called “root”
- People describe this hierarchical system as being like a tree. There is a main trunk, which holds smaller branches. The smaller branches hold even smaller branches, and maybe also some leaves. Branches can keep holding smaller branches

and also leaves. And the “bottommost” branches hold only leaves. In this analogy, branches are like directories and leaves are like files.

- Here is another analogy. Think of a filing cabinet. Inside there are multiple drawers. Each drawer holds multiple folders. Each folder may contain papers, or other folders. Those other folders in turn also store other folders or papers. In this analogy, the filing cabinet itself is like the root directory. The drawers and folders are like directories in your computer filesystem. And the papers are like files.
- Is there some way to see the files and directories on my computer graphically?
    - On Windows, the File Explorer makes this easy. You can see the hierarchy of directories on the left, and the contents of the “current” directory in the main window. If you click inside the top window (picture), you get the “path” to the selected directory or file. The path is simply a listing of all the nested directories that hold the selected file or directory. In the path, directories are typically separated by the ‘/’ character. And the root directory is denoted with the leading ‘/’.



    - In Mac, Finder can show file path (View::show file path) option. See the first picture above. (Cannot be searching for a file to enable this, according to LINK.)
- When you log into your computer (or any computer), you will have a “home” directory where you typically store your own files. On Linux and Mac, the symbol “~” is a shortcut for your home directory. Your home directory may have an actual path like “/Users/stephcurry” or “/home/users/stephcurry”.
- If you understand what a filesystem is, and how yours is set up on your computer, it hopefully makes it easier for you to organize your files so they are easy to find when you need them.
    - Some people made multiple different CS112 directories when doing the first lab, and they didn’t know where in their file system each was located. You can search in Windows File Explorer or Mac Finder to find these and clean them up, if needed. You should only have one CS112 directory.

Terminal window

- Much of our work on our computers is through the graphical user interface: clicking on icons to run programs, typing text into text editors, browsing the web, etc.
- But Windows, Mac, and Linux computers all include some form of terminal window that lets us run many commands by typing them in and hitting the ENTER key.
    - When we ran our “git add”, “git commit”, and “git push” commands, we were entering commands in a terminal window
- On Windows, there are a few different terminal windows. One is called “cmd” and another is called Windows PowerShell.
- On a Mac, the window is called a “terminal”. You can access it by typing “terminal” in the search box.
- A terminal window prints a “command prompt” that prompts you to enter a command. When you do, your computer runs the command and executes any resulting actions (printing text in your terminal window, opening windows, etc).
- Your terminal window has a “current directory” in your filesystem. If your commands specify files or directories, the path to those files is probably specified relative to the current directory.

Here are some commands you can enter in your terminal window to look at the filesystem, change your current directory, etc

- ls (‘dir’ on Windows) prints out (“lists”) all files and directories inside the current directory.
    - On Windows, ‘dir’ also prints the path to the current working directory
    - On Mac, type ‘pwd’ (print working directory) to get the path of the current directory
- You can change directories with the ‘cd’ command. From the current directory, to “dive down” into a directory inside the current directory by typing ‘cd NameOfTheDirectoryInside’. To “go up” one level, type ‘cd ..’ (You can go up two levels by typing ‘cd ../..’)
- You can jump directly to the root directory by typing ‘cd /’ . On Mac you can jump to your home directory by typing ‘cd ~’

- Please try this out in a terminal window: change directories and type ‘ls’ to see what is there. Can you match up what you see in the terminal window with what you see in Finder or Windows Explorer?

You can make changes to the filesystem from the terminal also

- mv OldFilename NewFilename renames the file called ‘OldFilename’ to ‘NewFilename’ . Command is ‘move’ on Windows
- cp OldFilename NewFilename makes a copy of OldFilename and names the new version ‘NewFilename’
- rm NameOfAFile removes the file called ‘NameOfAFile’. On windows, this command is ‘del’. Unlike with Finder or Windows Explorer, there is no undo! The file is lost forever.
- mkdir NewDirectory makes a new directory inside the current directory named ‘NewDirectory’
- rmdir DirectoryName removes a directory inside the current directory named ‘DirectoryName’. DirectoryName must be empty

Why would we ever use the terminal window instead of a graphical interface?

- Some programs (like git and javac) are only available in the terminal window
- We can write ‘scripts’ that contain multiple commands that we frequently use all together. Those scripts can be run quickly and easily without having to type in (or click on the gui) multiple commands
- With practice, some operations are faster to type in than to execute with multiple clicks.

Windows	**Mac**	**What it does**	**Notes**
dir	ls	Lists all files in the directory	On Windows, ‘dir’ also prints the path to the current working directory
-	pwd	Lists the present working directory	Mac only
cd <directory name>	cd <directory name>	Changes pwd to the <directory name>	<directory name> can be a full “path” to the directory. .. (two periods) means “go up one level in the directory hierarchy.

copy OldFileName NewFileName	cp OldFileName NewFileName	Makes a copy of the file named ‘OldFileName’ and calls the new copy ‘NewFileName’	
move OldFileName NewFileName	mv OldFileName NewFileName	Renames the file named ‘OldFileName’ to ‘NewFileName’	

Summary of some basic commands

Further reading:
https://www.guru99.com/terminal-file-manager.html
https://www.macworld.com/article/221277/command-line-navigating-files-folders-mac-terminal.html
https://www.thewindowsclub.com/commands-to-manage-files-and-folders-through-cmd